



STGP12NB60HD

N-CHANNEL 12A - 600V TO-220

PowerMESH™ IGBT

TYPE	V _{CES}	V _{CE(sat)}	I _C
STGP12NB60HD	600 V	< 2.8 V	12 A

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP (V_{CEsat})
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCH™
- ANTIPARALLEL DIODE

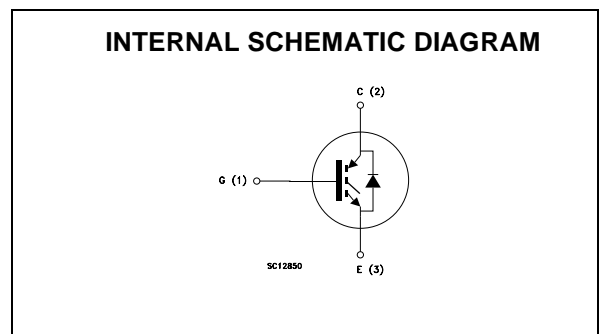
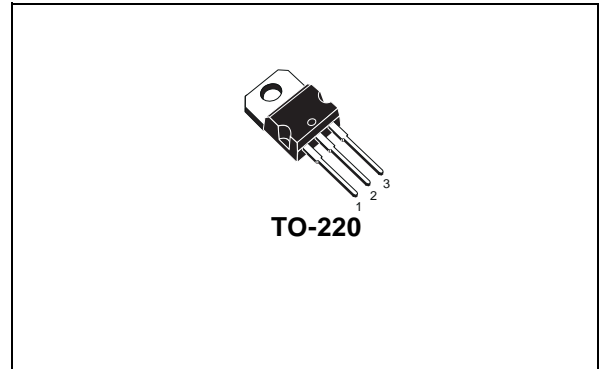
DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances.

The suffix "H" identifies a family optimized for high frequency applications (up to 50kHz) in order to achieve very high switching performances (reduced t_{fall}) maintaining a low voltage drop.

APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS and PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- UPS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CES}	Collector-Emitter Voltage (V _{GS} = 0)	600	V
V _{ECR}	Emitter-Collector Voltage	20	V
V _{GE}	Gate-Emitter Voltage	± 20	V
I _C	Collector Current (continuous) at T _C = 25°C	24	A
I _C	Collector Current (continuous) at T _C = 100°C	12	A
I _{CM} (■)	Collector Current (pulsed)	96	A
P _{TOT}	Total Dissipation at T _C = 25°C	100	W
	Derating Factor	0.8	W/°C
T _{stg}	Storage Temperature	-65 to 150	°C
T _j	Max. Operating Junction Temperature	150	°C

(■) Pulse width limited by safe operating area

STGP12NB60HD

THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	1.25	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W
Rthc-sink	Thermal Resistance Case-sink Typ	0.5	°C/W

ELECTRICAL CHARACTERISTICS (T_{CASE} = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{BR(CES)}	Collector-Emitter Breakdown Voltage	I _C = 250 µA, V _{GE} = 0	600			V
I _{CES}	Collector cut-off (V _{GE} = 0)	V _{CE} = Max Rating, T _C = 25 °C V _{CE} = Max Rating, T _C = 125 °C			10 100	µA µA
I _{GES}	Gate-Emitter Leakage Current (V _{CE} = 0)	V _{GE} = ± 20V, V _{CE} = 0			±100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{GE(th)}	Gate Threshold Voltage	V _{CE} = V _{GE} , I _C = 250 µA	3		5	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15V, I _C = 12 A V _{GE} = 15V, I _C = 12 A, T _J = 125°C		2.0 1.7	2.8	V V

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g _{fs}	Forward Transconductance	V _{CE} = 15 V, I _C = 12 A		10		S
C _{ies}	Input Capacitance	V _{CE} = 25V, f = 1 MHz, V _{GE} = 0		920		pF
C _{oes}	Output Capacitance			120		pF
C _{res}	Reverse Transfer Capacitance			27		pF
Q _g Q _{ge} Q _{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V _{CE} = 480V, I _C = 12 A, V _{GE} = 15V		68 10 30		nC nC nC
I _{CL}	Latching Current	V _{clamp} = 480 V, T _J = 150°C R _G = 10 Ω	48			A

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t _{d(on)} t _r	Turn-on Delay Time Rise Time	V _{CC} = 480 V, I _C = 12 A R _G = 10Ω, V _{GE} = 15 V		5 46		ns ns
(di/dt) _{on} E _{on}	Turn-on Current Slope Turn-on Switching Losses	V _{CC} = 480 V, I _C = 12 A R _G = 10Ω, V _{GE} = 15 V, T _J = 125°C		800 290		A/µs µJ

ELECTRICAL CHARACTERISTICS (CONTINUED)**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_c	Cross-over Time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$		150		ns
$t_r(V_{off})$	Off Voltage Rise Time			27		ns
$t_{d(off)}$	Delay Time			76		ns
t_f	Fall Time			92		ns
$E_{off(**)}$	Turn-off Switching Loss			0.21		mJ
E_{ts}	Total Switching Loss			0.49		mJ
t_c	Cross-over Time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_{GE} = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_j = 125\text{ }^\circ\text{C}$		230		ns
$t_r(V_{off})$	Off Voltage Rise Time			76		ns
$t_{d(off)}$	Delay Time			95		ns
t_f	Fall Time			200		ns
$E_{off(**)}$	Turn-off Switching Loss			0.45		mJ
E_{ts}	Total Switching Loss			0.74		mJ

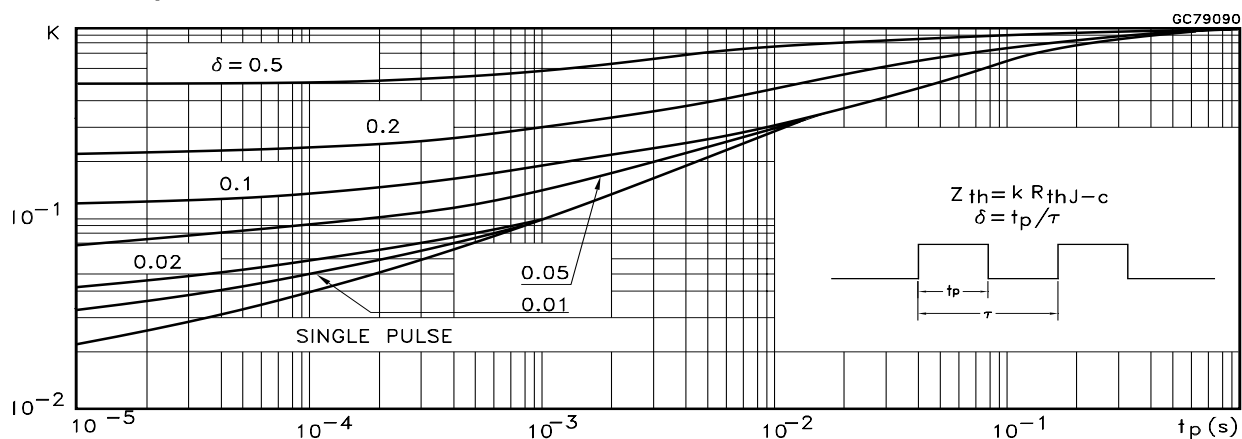
COLLECTOR-EMITTER DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_f	Forward Current				12	A
I_{fm}	Forward Current pulsed				48	A
V_f	Forward On-Voltage	$I_f = 6\text{ A}$ $I_f = 6\text{ A}$, $T_j = 125\text{ }^\circ\text{C}$		1.3	1.9	V
				1.1		V
t_{rr}	Reverse Recovery Time	$I_f = 6\text{ A}$, $V_R = 50\text{ V}$, $T_j = 125\text{ }^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$		80		ns
Q_{rr}	Reverse Recovery Charge			240		nC
I_{rrm}	Reverse Recovery Current			5.5		A

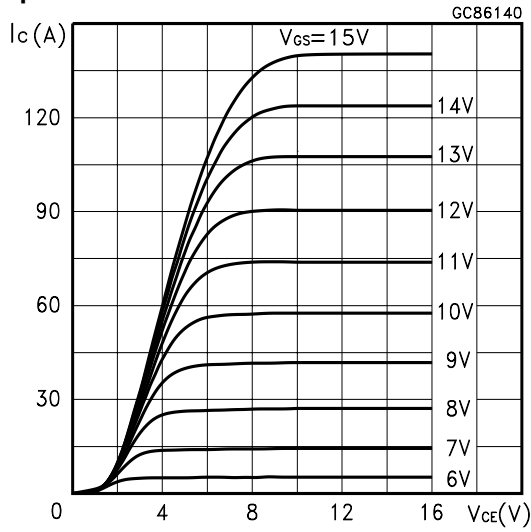
Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.

2. Pulse width limited by max. junction temperature.

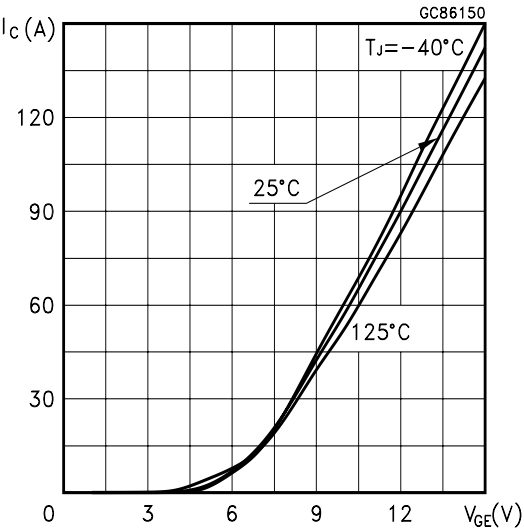
(**) Losses include Also the Tail (Jedec Standardization)

Thermal Impedance

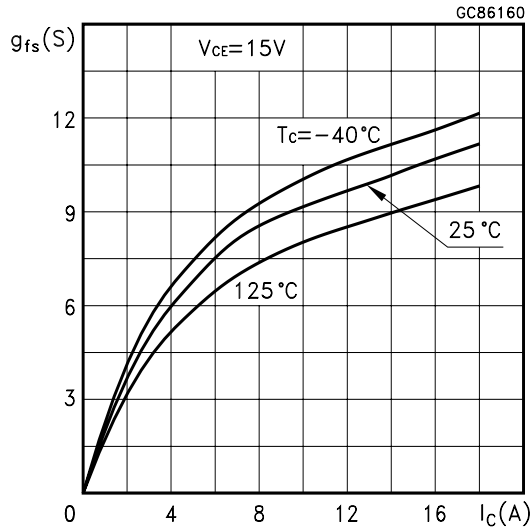
Output Characteristics



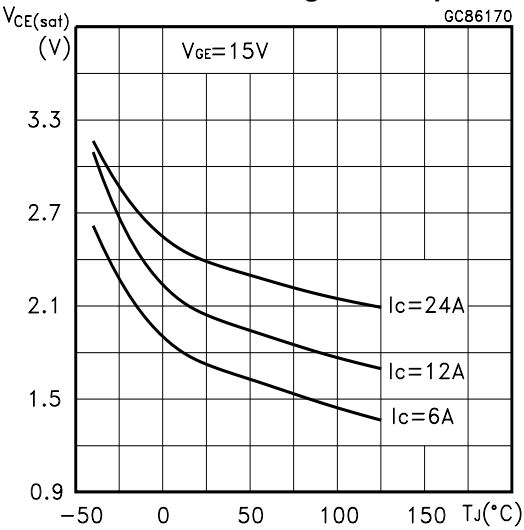
Transfer Characteristics



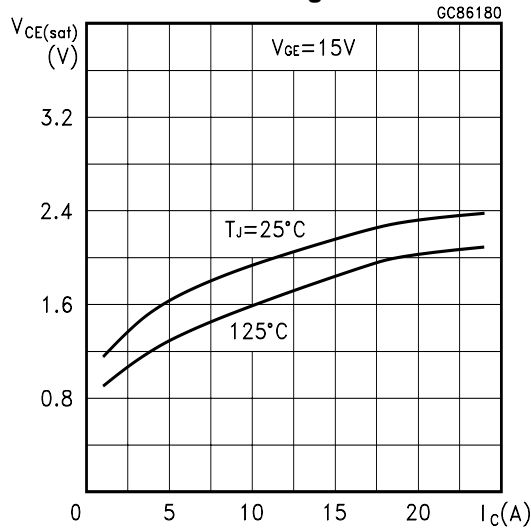
Transconductance



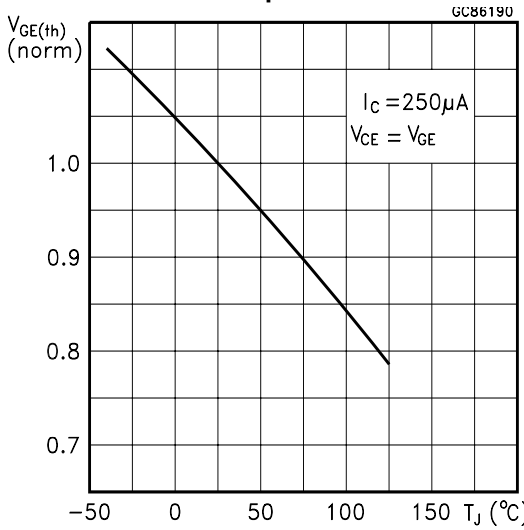
Collector-Emitter On Voltage vs Temperature



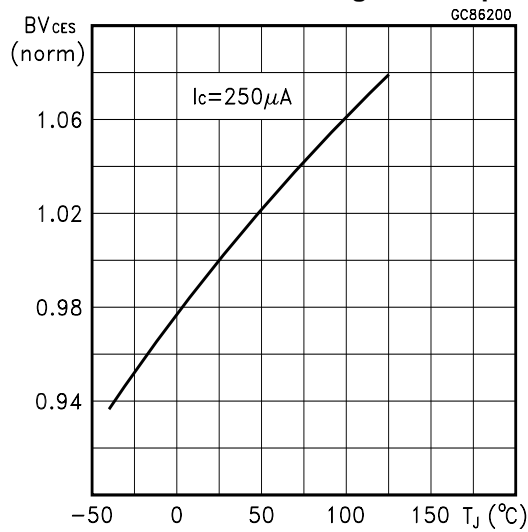
Collector-Emitter On Voltage vs Collector Current



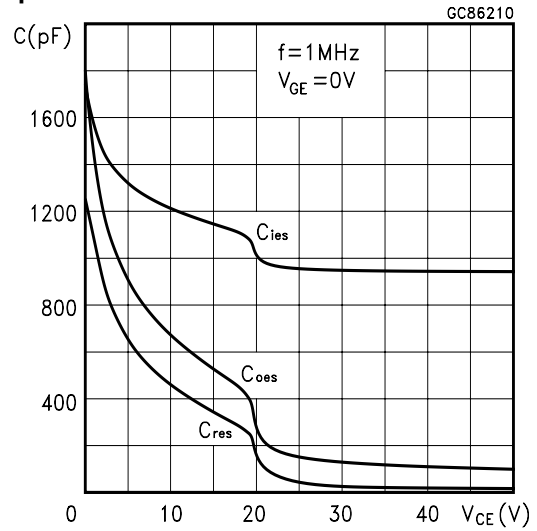
Gate Threshold vs Temperature



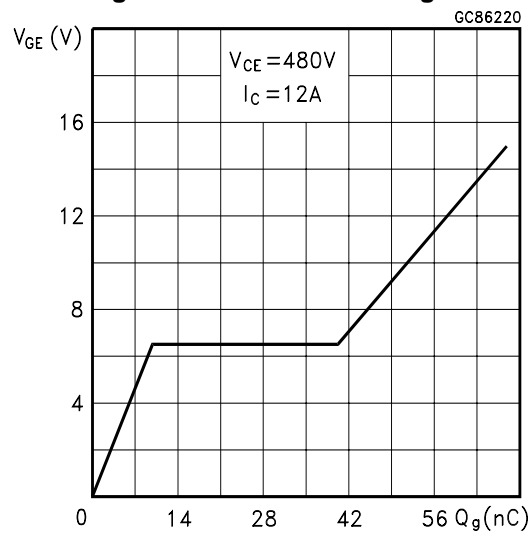
Normalized Breakdown Voltage vs Temperature



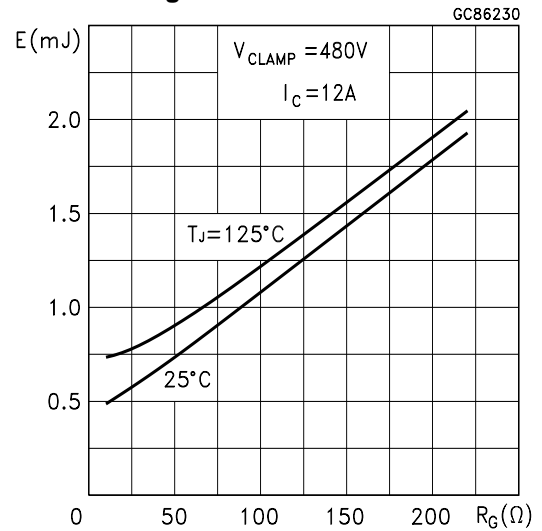
Capacitance Variations



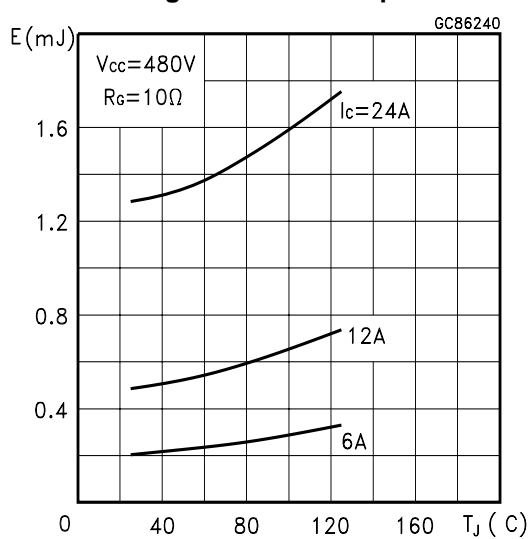
Gate Charge vs Gate-Emitter Voltage



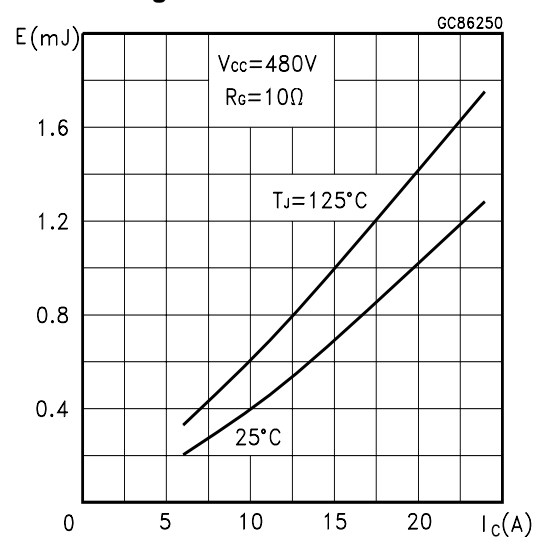
Total Switching Losses vs Gate Resistance



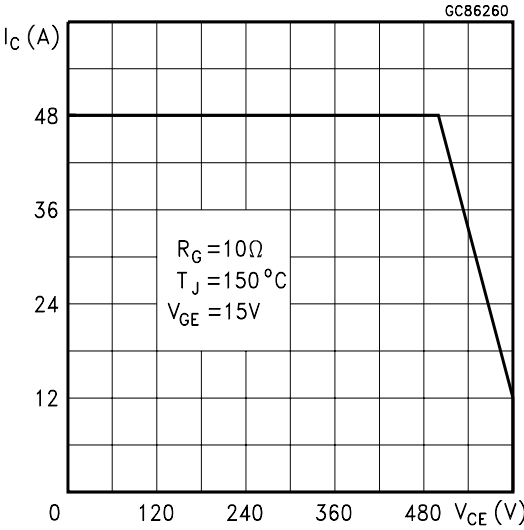
Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



Switching Off Safe Operating Area



Diode Forward Voltage

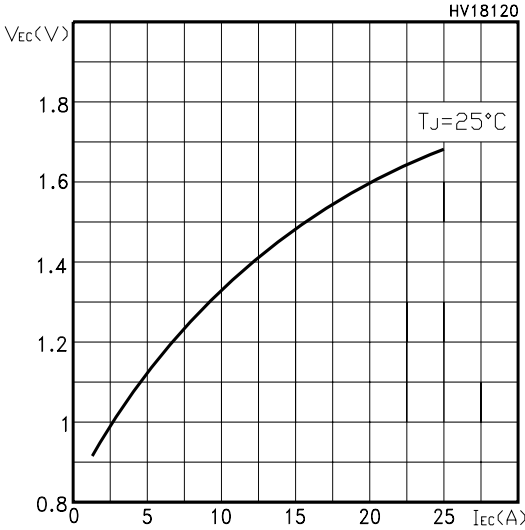


Fig. 1: Gate Charge test Circuit

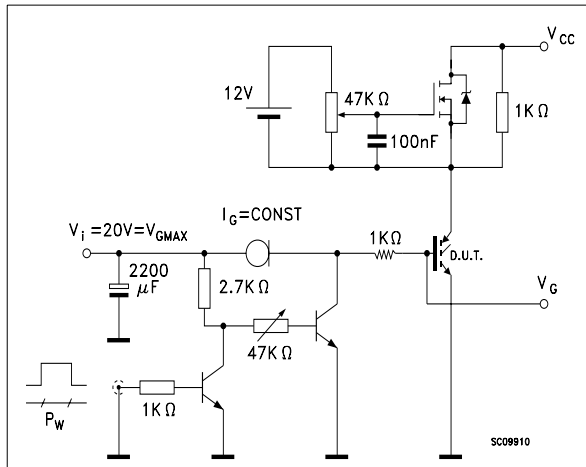
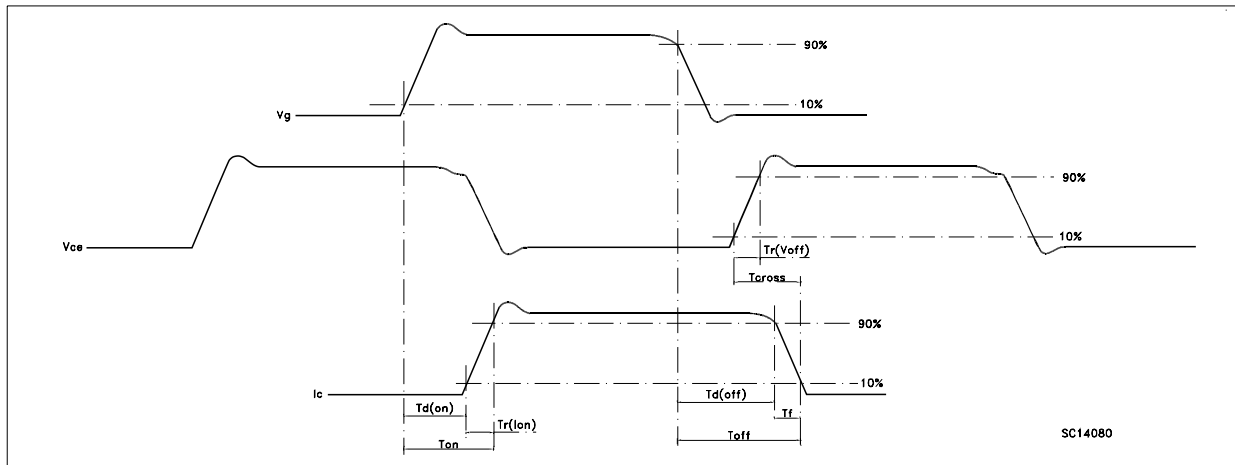
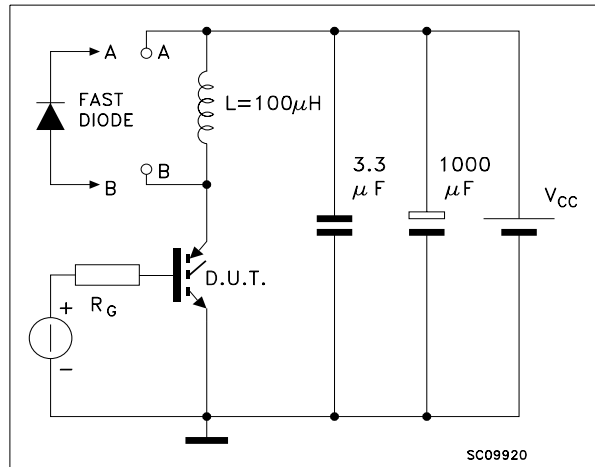
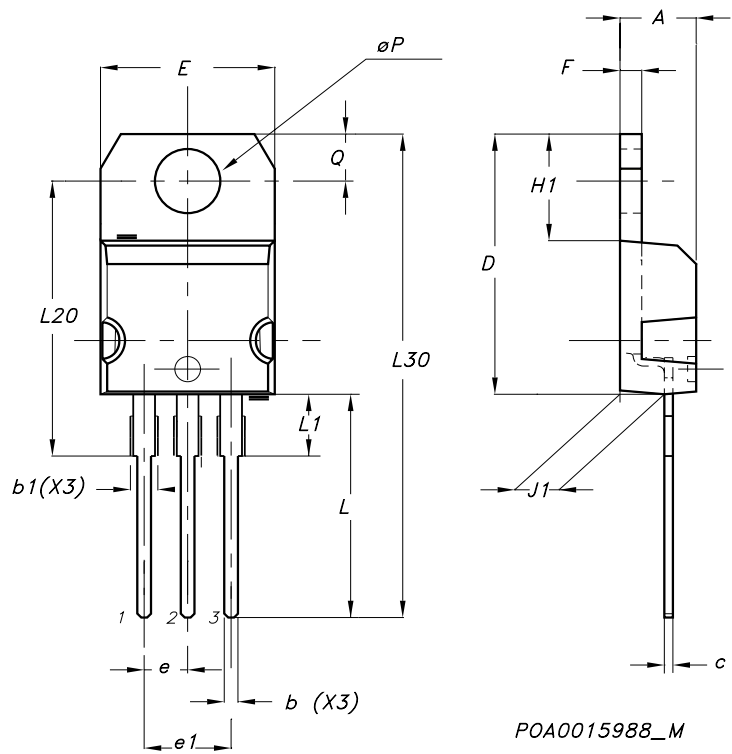


Fig. 2: Test Circuit For Inductive Load Switching



TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



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